

## Study on Metal Materials Using Green Chemistry

Joern Viell\*

Department of Science and Engineering, Karadeniz Technical University, Trabzon, Turkey

### DESCRIPTION

The Metal-Organic Framework (MOF) is a class of hybrid networks of supramolecular solid materials containing numerous inorganic and organic linkers, all bound to metal ions in a well-organized manner. The Zeolite Imidazolate Framework (ZIF) is a subset of MOFs that contain imidazole as an organic linker to metals. ZIF combines the classic zeolite properties of thermal and chemical stability with adjustable pore size and a variety of MOF topologies. Due to the presence of organic solvents that lead to energy crises and environmental hazards, significant work efforts have been made to develop clean and sustainable synthetic routes to reduce the environmental impact of ZIF production. Green chemistry is the key to sustainable development as it leads to new solutions to existing problems. In addition, it offers new process and product opportunities and is at the heart of science and technology innovation. The green chemistry approach aims to redesign the materials that support our society and economy, including the materials that generate, store and transport our energy, in a sustainable way for people, the environment and nature.

This study describes the principles of green chemistry used in designing strategies for synthesizing more environmentally friendly and less toxic ZIFs that can be produced with less energy. First, we discuss the need for green practices in today's society, their replacement with regular non-green practices, and their benefits. Next, we will explore different methods of green synthesis of ZIF compounds, including hot water, ionothermal, and electrospray techniques. These are more economical, using the least harmful and least toxic substances, especially with respect to organic solvents. When compounds are synthesized by the green process, the question arises as to whether these compounds can replace the same compounds synthesized by the non-green process. For example, the thermal stability of these compounds (which is one of the most important functions of ZIF's) maintained or not. Similarly the exceptional chemical stability has to be considered as well. Therefore, after studying the way to discover these compounds, the final component will discuss in various uses of the green synthetic compounds.

According to the study, zeotypes with more than 180 framework topologies are considered to be the most important technical

nanoporous inorganic materials. In addition to alminosilicate zeolites, researchers in the 1980s and 1990s have identified several zeolite-like inorganic materials, such as transition metal phosphate and Aluminum Phosphate ( $\text{AlPO}_4$ ). In addition, experts in this field have done a lot of research to develop a new class of zeolite structures based on the Hybrid Metal-Organic Framework (MOF). The purpose of this study was to enlarge the pore size, improve its function, and discover new catalysts and sorption properties.

In recent years, studies have considered a lot about organometallic porous materials for attractive applications in separation, molecular recognition, and catalysis. However, they faced challenges in building open MOFs, including strengthening and adjusting pore dimensions to produce porous organometallic materials with higher stability. Examiners have proposed several strategies for increasing pore size by enlarging organic units, but these systems lead to mutual instability of the framework. In addition, MOFs offer advantages such as superior structural architecture, larger surface area, stronger host-guest interactions, drug delivery, catalysis, separation and powerful applications in gas scavenging and storage. The methodology for producing rigid and stable MOFs with larger pores is based on the extension of the zeolite topology by the production of organic tetrahedral metal building blocks. Therefore, examiners have selected four coordination transition metals for the Tetrahedral atom (T) of the zeolite and imidazolidine as the linkers or vertices (X) for T. They want the resulting organometallic polymer to have an open framework with a zeolite topology. However, the use of imidazolides as linkers cannot be randomly selected and is conscious due to the orientation of the two coordinate nitrogen atoms of the imidazolides at an angle of  $144^\circ$  to each other, similar to the  $145^\circ$  angle of oxygen coordination have been selected in zeolite. Concerns have been raised regarding the formation of a porous Zeolite-like Metal Organic Framework (ZMOF) in which a transition metal replaces an organic ligand bond with a tetrahedral coordinated Si or Al atom and replaces the oxygen bridge of the zeolite. Study have also provided several MOFs with a zeolite-like framework. Compared to normal neutral MOFs, ZIF has an anionic framework, many of which are believed to be charge compensated by additional framework ions in the cavity that can

**Correspondence to:** Joern Viell, Department of Science and Engineering, Karadeniz Technical University, Trabzon, Turkey, Tel/Fax: +90 675615236; E-mail: joernviell88@gmail.com

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be ion exchanged with alkali metals. Recent studies have displayed the synthesis of nearly 20 ZIFs, so one of those subgroups actually has a framework topology similar to zeolite. When combined with a functionalized imidazolide anion or

imidazolide, a large number of ZIFs are composed of Co or Zn ions. ZIF has excellent chemical and thermal stability and is free of Lewis acid sites and Bronsted acid sites that can catalyze the polymerization of olefins in the pores.